METEORITES

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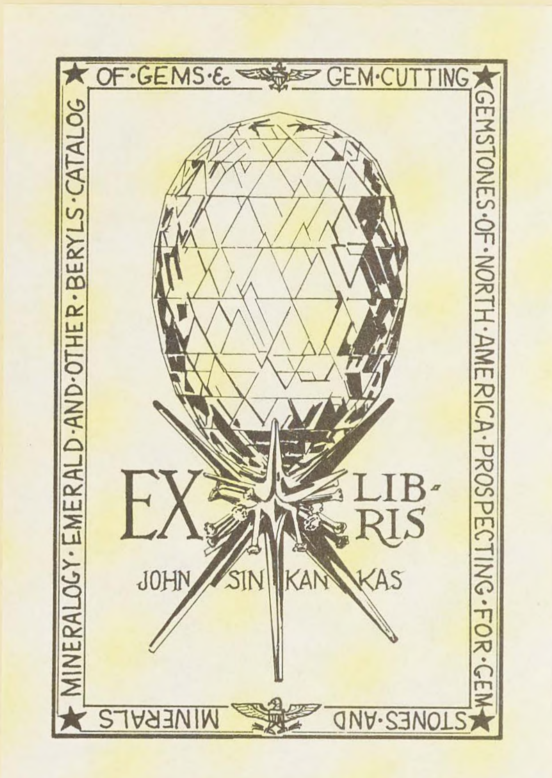
Recent Additions to the Meteorites in the Foyer

BY

EDMUND OTIS HOVEY

[Reprinted from THE AMERICAN MUSEUM JOURNAL, Vol. IX, pp. 237-248. December, 1909.]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Recent Additions to the Meteorites in the Foyer

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THE GUFFEY, COLORADO, METEORITE.

IN November, 1907, two cowboys, Robert L. Pope of Canyon City, Colorado, and J. T. Witcher of Guffey, Park Co., Colorado, discovered an iron meteorite while they were riding after their cattle along the head waters of the Freshwater River. The exact location of the find is the N. E. $\frac{1}{4}$ of the N. E. $\frac{1}{4}$ of Section 16, Township 35, Range 72, 6th Principal Meridian, W. in Freemont County, Colorado. The nearest post office is Guffey, Park County, about three and one half miles from the spot where the iron was found. The cowboys secured help and at last succeeded in getting the mass out of the mountains and to Cripple Creek. The American Museum purchased it from the finders, and it is now on exhibition in the foyer.

Guffey, as it must be called from the name of the post office nearest to the spot where it was found, is a "siderite," or wholly metallic meteorite $36\frac{1}{2}$ inches long, 15 inches in maximum height and 8 inches wide. Its weight is 682 pounds. The mass is roughly pear-shaped, but much flattened. One edge is so straight and is so nearly rectangular with reference to the adjoining sides that it seems like a definite fracture, indicating the possibility of there being another fragment or other fragments of the meteorite in the vicinity of the spot where this was found. The surface of the iron is covered with an extremely thin film of black iron oxide, which looks as if it might be the original skin formed by the passage of the meteorite through the air. At any rate, the iron is free from rusty scale and apparently had not lain long upon the mountain before it was found. The statement is made that a vivid meteor passed over the Freshwater River region in the fall of 1906, and the supposition is that this mass is a part of it. The evidence, however, is not strong in support of this theory. The cowboys who found the iron were not searching for a meteorite, and in fact did not know that they had found one. The brilliant white color disclosed on rubbing the surface led them to suppose that they had found a mass of pure silver, and they started to get it to town accordingly, after making an unsuccessful effort to cut off the small end of the specimen.

Two sides show in good development the "thumb marks" or "piëzoglyphs" characteristic of meteoritic masses. These markings are particularly deep upon the flat side shown in Figure 2, and they are less

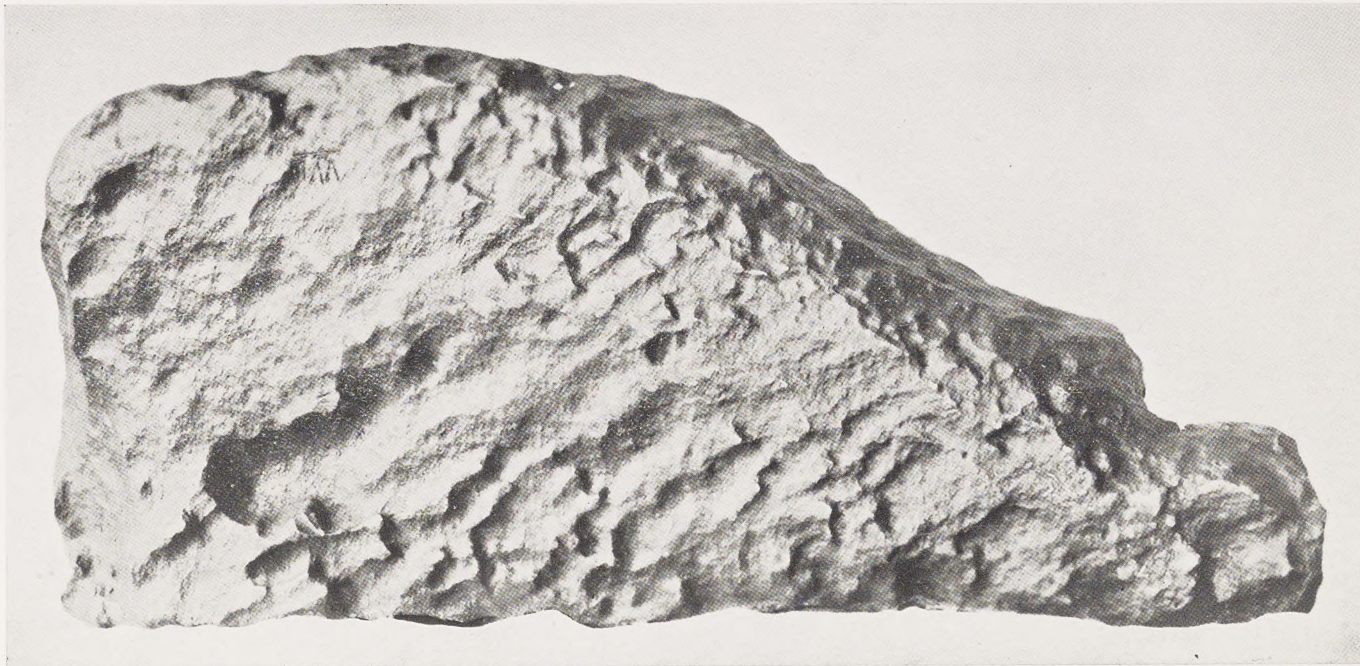


FIG. I. GUFFEY METEORITE. FRONT, OR "BRUSTSEITE".

Shows furrows and subconical pits due to flowage as a result of superficial melting produced by friction with the air. These furrows and points indicate that the meteorite passed through the air with this side and the upper right hand end in front most of the time.

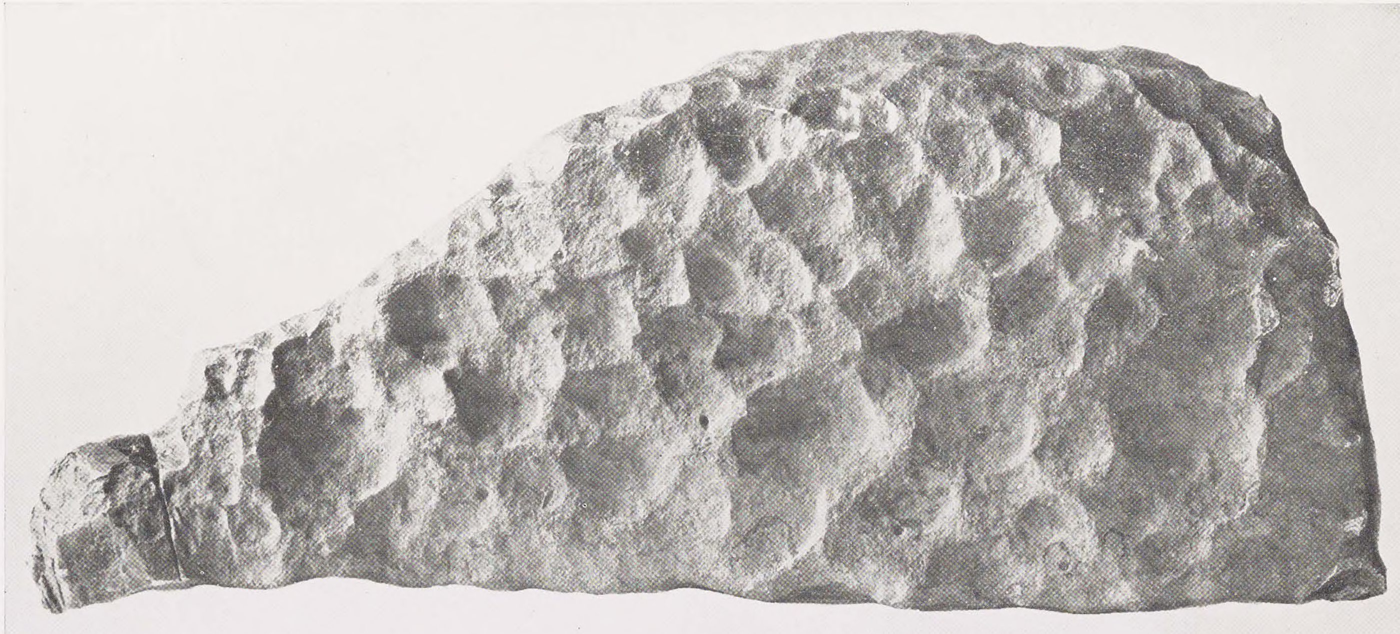


FIG. 2. GUFFEY METEORITE. REAR SIDE, PROTECTED DURING ITS JOURNEY THROUGH THE AIR.

The depressions called thumb-marks or piëzoglyphs, which usually cover the surface of a meteorite, are strongly developed on this side of the mass.

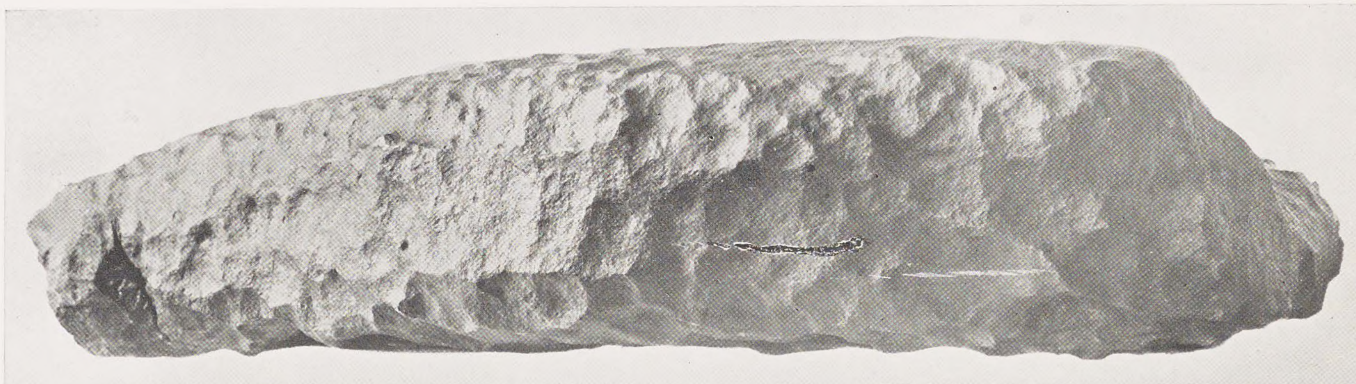


FIG. 3. GUFFEY METEORITE. UPPER EDGE OF MASS AS EXHIBITED.

The upper left hand portion of this edge probably was in front during most of the meteorite's flight through the air. The surface is indented with numerous thumb-marks and flow furrows.

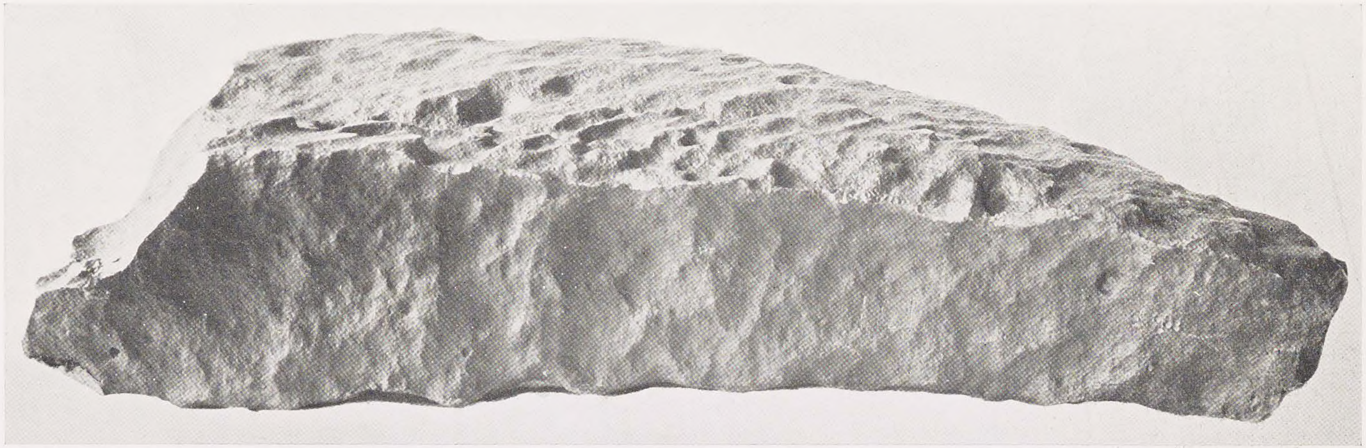


FIG. 4. GUFFEY METEORITE. LOWER EDGE OF MASS AS EXHIBITED.

Showing the straight, almost rectangular relation of this surface to its neighbors, which indicates a probable fracture of the original mass, while in the air. Piëzoglyphs, or thumb marks, are poorly developed on this surface.

pronounced and somewhat more elongated in the round edge shown in Figure 3. The flat side shown in Figure 1 has comparatively few round piëzoglyphs, but it has many pits, grooves and points due to the flowing of the melting surface of the mass during flight through the atmosphere. The almost square edge, which is illustrated in Figure 4 and which is considered to be an abrupt fracture occurring when the meteorite was near the end of its atmospheric flight, has an oxidized skin like the rest of the mass but shows piëzoglyphs very imperfectly.

Figure 1 shows the side which was in front during most of the meteorite's atmospheric flight and is called by the Germans the "brustseite." The position of the furrows indicates that the line of flight was toward the upper right hand quarter of the mass as shown in this picture. Although the iron is unusually uniform and dense in structure, as will be brought out under the discussion of its composition, it evidently yielded unequally to the heat produced by friction with the atmosphere, and the air in passing over its surface plowed deep furrows ending in subconical pits and left sharp projections pointing forward in the direction of flight.

A piece of the iron which had been sawed from the small end of the mass was polished and etched with dilute nitric acid at the Museum and was afterwards polished again and treated with dilute and strong nitric acid and picric acid in succession by the chemists, Booth, Garrett and Blair, Philadelphia, picric acid proving to be the best mordant. The surface does not show the Widmanstätten lines usually characteristic of meteoritic iron, but instead it possesses an extremely fine granular crystalline structure, which is shown magnified 100 diameters in Figure 5 from a photomicrograph made by the analysts. The homogeneous character of the mass and the paucity of nonmetallic contents are indicated by the high specific gravity. The chemical analysis, made by Booth, Garrett and Blair, resulted as follows:

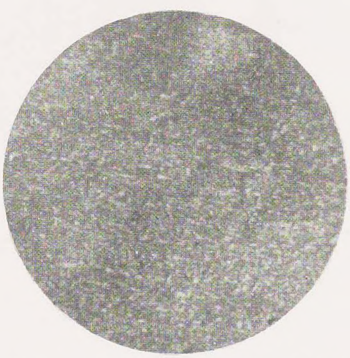


FIG. 5. GUFFEY METEORITE. PHOTOMICROGRAPH.

Polished section magnified 100 diameters to show cryptocrystalline structure.

Iron	88.687%
Nickel	10.547%
Cobalt	0.546%
Chromium	0.018%
Manganese	none
Carbon	0.025%
Silicon	none
Sulphur	0.016%
Phosphorus	0.020%
Total	99.859%

Specific gravity, 7.939.

This analysis shows that the Guffey meteorite contains rather more than the average percentage of nickel and cobalt and unusually low percentages of carbon, sulphur and phosphorus. The extremely small amount of sulphur found indicates the practical absence from the mass of troilite, the protosulphide of iron which is found only in meteorites. This inference is substantiated by the few particles of this mineral which are to be seen on careful examination of the surface. The low content of phosphorus might have been inferred from the practical absence of schreibersite (a phosphide of nickel and iron characteristic of meteorites) as shown by the polished and etched specimen, this mineral being the substance that usually brings the Widmanstätten lines out in relief.

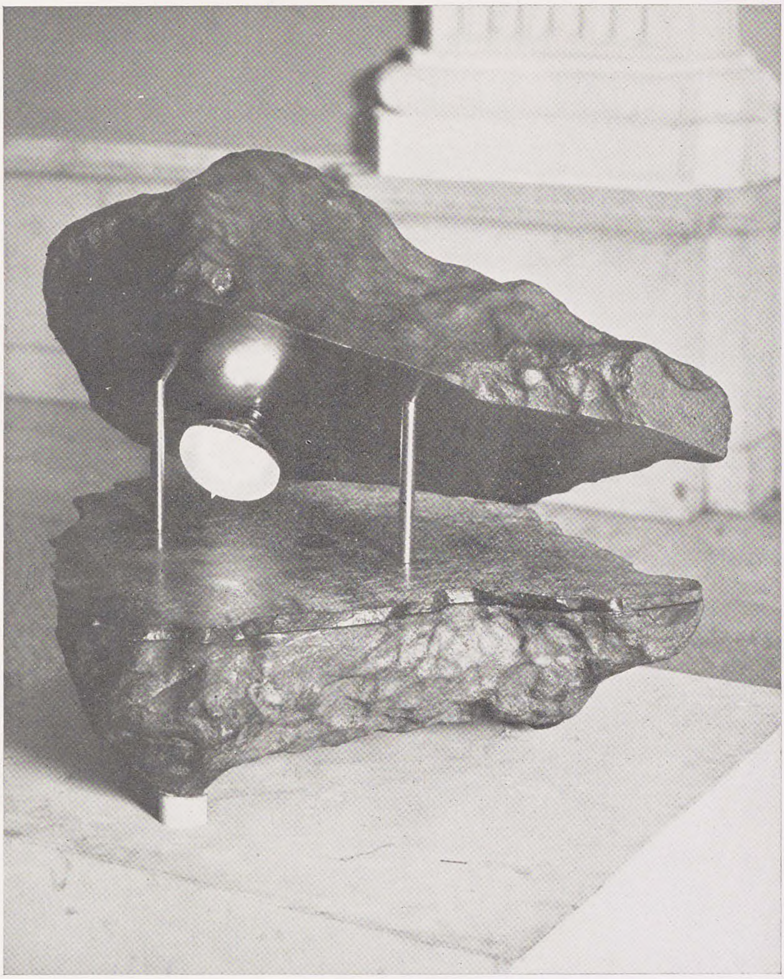
EDMUND OTIS HOVEY.

RECENT ADDITIONS TO THE METEORITES IN THE FOYER.

DURING the past summer three important accessions were installed among the meteorites in the Foyer. They were (1) the newly discovered iron known as Guffey which is described elsewhere in this issue of the JOURNAL, (2) a slice and cast of the iron meteorite called Gibeon and (3) the largest known portion, weighing 20 pounds 3 ounces, of the stone meteorite Modoc.

The manner of installing the Gibeon section is a new departure in the mounting of meteorites, as far as we know. About two years ago we received through exchange with the Natural History Museum of Hamburg, Germany, a plaster cast of the larger of the two known por-

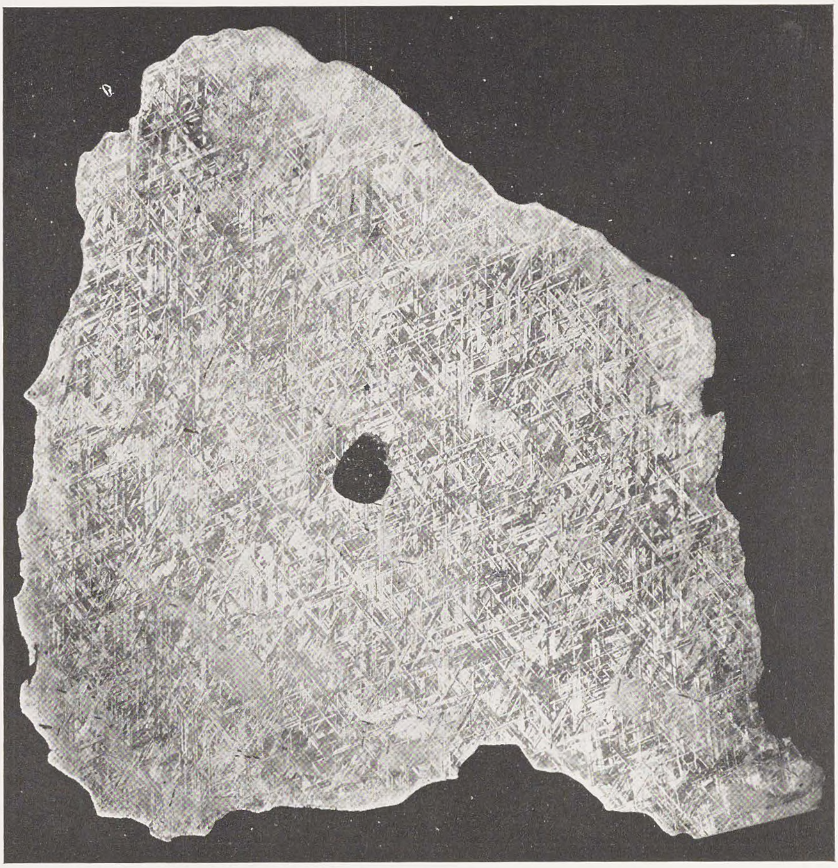
GIBEON IRON METEORITE. GENERAL VIEW.



GIBEON IRON METEORITE. GREAT NAMAQUA LAND, AFRICA.

Cast iron reproduction with etched slice of original in its proper position. The electric light has been inserted in order to display clearly the "Widmanstätten lines" that show the crystalline character of meteoritic iron and the lack of such lines in artificial iron.

tions of this interesting find, together with a polished and etched slice giving a complete section of the mass in its greatest dimensions and showing in remarkably beautiful development the Widmanstätten lines that are generally characteristic of meteoritic iron. The original mass weighed 562 pounds. We determined the correct position of the slice in



GIBEON IRON METEORITE. POLISHED AND ETCHED SECTION.

One fourth natural size.

the plaster cast, cut the latter in two and fitted the slice into its proper place. Then we had each portion of the plaster cast reproduced in cast iron, and hinged the two parts together, with the natural section in its original position, thus showing not only the appearance of the mass

as found but also its internal crystalline structure. We also polished the opposing surface of the cast iron reproduction and treated it with dilute nitric acid in the same manner as the meteorite itself had been treated, in order to bring out the fact that artificial iron does not possess the crystalline structure which is so characteristic of the other. A natural depression fortunately pierced the upper half of our cast and gave us an ideal way of introducing an electric light to enable visitors to see clearly the Widmanstätten lines of the meteorite and the amorphous character of the cast iron.

The meteorite takes its name from the little village of Gibeon whose geographical position is about 25° 8′ South latitude and 17° 50′ East longitude in the eastern part of Great Namaqua Land, in German southwest Africa, the home of the Hottentot. Two other famous iron meteorites have been found within a radius of 125 miles of Gibeon: Mukerop, of which there is a fine slice in the Ward-Coonley collection of meteorites, now in our Hall of Geology, and Lion River, which came from near the hamlet of Bethany and is represented by a small part of a slice in our general series. The latter has been known for more than half a century, having been described by Prof. C. U. Shepard in 1856. The former has come to public notice more recently. It resembles Gibeon in crystalline structure so closely that some authorities have been inclined to consider them parts of the same fall. Lion River, however, is entirely distinct in character.

Modoc is an aërolite or stony meteorite that was seen to fall near the town of Modoc, Scott County, Kansas, and the occurrence is described by Mr. J. K. Freed, an eyewitness of the fall and the finder of our specimen, as follows:

"The meteorite appeared as a ball of fire in the west September 2, 1905, at 10 o'clock in the evening, the sky being cloudless and the clear atmosphere of the plains being undisturbed by wind. From Scott City to Syracuse, 75 miles southwest, it was light enough to read common newspaper print on the street and the explosions rattled doors and windows. The mass exploded, and then the resulting fragments exploded several times in rapid succession. The fragments gleamed brightly at first but their light went out almost immediately after the explosions. Then came the sounds of the explosions, the whistling like bullets or heavy hail of the smaller fragments and a most intense humming like that of a rapidly revolving cylinder of some heavy machine, evidently caused by the larger mass. This was followed by

fierce cannonading (echoes of the explosions?) like the discharge of a battery of artillery or a rapid-fire machine gun, gradually growing fainter and dying out like rolling thunder in the distance. The first explosion took place about 40 miles west of the fall and fully as far above the surface of the earth. The fragments were scattered over an area nine miles by three; the largest ones going farthest. I heard the largest one drop and hunted for it for over two years.

"On May 6, 1908, I was breaking new ground on the prairie with a gang-plow and a five horse team that was a little too high-spirited to be controlled easily, but having half-mile furrows as smooth as a lawn before me, I had set the plow a few notches deeper into the ground and let them go, thinking nothing of meteorites. While congratulating myself upon our speed we suddenly — very suddenly — struck something hard. It threw me out of my seat and piled my gang-plow up in a promiscuous heap against the team, which was too badly surprised to do anything. I had plowed hundreds of acres and knew there was not a rock within ten miles of me, so my first thoughts were of dynamite. After sitting for some time trying to think, I ventured back to where my plow had left the ground. Seeing nothing, I commenced stabbing with my jack-knife and soon located the cause of the disturbance. It was the largest fragment of the Modoc meteorite and completely buried under the tough buffalo sod (virgin soil) and was pounded in so hard that the force of the blow of my gang-plow had not loosened it. So completely was it buried, that I had hunted dozens of times all over that pasture without either finding the rock or the hole in the ground which it had made."

Twenty-five fragments of Modoc have been found. All are covered with the thin glassy black coating or "skin" that is generally characteristic of aërolites and that is caused by the melting of the surface in the great heat generated by friction with the air during flight through the earth's atmosphere. Flakes broken off by the plow reveal the interior of the mass and show that the meteorite is composed of whitish stony material like some terrestrial lavas, but containing bright specks of metallic iron.